BUCKET AND RIGGING ASSEMBLY FOR AN EXCAVATING BUCKET

BACKGROUND OF THE INVENTION

This invention relates to digging and excavating machines and, more particularly, to digging buckets and bucket rigging used with such machines.

Machines for digging and excavating are available in a wide variety of fundamental types and a variety of configurations within each type. For example, common types of digging and excavating machines include front-end loaders, backhoes and scrapers.

Another type of excavating machine is known as a dragline. Draglines are often used for mining where the mineral being sought, e.g., coal or ore, is relatively close to the surface of the earth. A dragline is equipped with a boom from which is suspended a bucket.

To excavate, the dragline bucket is placed on the ground away from the machine. With its teeth rearward (facing the machine), such bucket is drawn (or "dragged") toward such machine by taut cable. When the bucket is filled, other cables hoist it, and the machine is then rotated to dump the bucket contents onto a pile.

The bucket is suspended from the end of the boom by parallel cables made of steel strands, referred to as wire ropes. The wire ropes extend downwardly from the end of the boom and are terminated at their lower ends by hoist sockets. A bucket rigging assembly extends downwardly from the sockets and attaches to the digging bucket. Known rigging assemblies include hoist chains, pickup links, dump blocks and other components. In particularly, known rigging assemblies are

connected to the digging bucket by trunnions provided on both sides of the bucket. Sometimes the trunnions are on the inside of the bucket, and then other times on the outside of the bucket. Accordingly, two hoist chains are used to connect the rigging to the bucket, and a spreader bar keeps the hoist chains from contacting the bucket sides. The chains and spreader bar constitute a significant part of the rigging weight.

Buckets and their rigging assemblies can be (and usually are) very large and heavy. For example, dragline buckets having a capacity of 80 cubic yards, i.e., large enough to hold several automobiles, are relatively common. Empty, such buckets may weigh on the order of 45-50 tons and assuming that a cubic yard of material being excavated weighs 1800-2000 pounds, such buckets lift 75-80 tons of material on each digging cycle. The rigging assembly for an 80-yard bucket weighs on the order of 24 tons. Draglines with 150 to 220 yard buckets are not unheard of. A large dragline can create a pile of excavated material that is 200 feet high or so.

SUMMARY OF THE INVENTION

One of the principal objects of the invention is to reduce the weight of current bucket rigging. The problem is that every kilogram of bucket and rigging is one kilogram less of materials that can be moved each swing by the dragline due to the suspended load limitations of the dragline design. The lighter the rigging, the larger and more productive the bucket can be.

Another object of the invention is to provide an improved rigging assembly that has a reduced number of component parts.

Another object of the invention is to reduce the bucket and rigging weight by revising the attachment of the bucket to the rigging, by reducing the number of rigging components and by

revising the bucket design to reduce weight so the bucket capacity can be increased accordingly.

Another object of the invention is to reduce the number of hoist chains in the dragline rigging from 2 to 1.

Another object of the invention is to eliminate the spreader bar and its associated components and complication.

More particularly, this invention provides a new bucket design including one central hoist trunnion, and a single hoist chain attached to the central hoist trunnion. The bucket design is very different to conventional buckets due to the single hoist chain set-up. Weight can therefore be removed from the top rail and the side plates and some put back into the bucket floor, which is now the major load-bearing element. The new result is a modest weight saving that can be put back into payload.

The single hoist chain rigging allows the spreader bar to be eliminated along with various other components thereby achieving a significant weight reduction, which can be put back into payload.

The combined weight reduction of the bucket and rigging can also be invested in a stronger bucket structure for the applications where the more arduous mining conditions dictate a heavier bucket be utilized.

This invention also provides a rigging assembly including spaced apart first and second hoist sockets, a hoist chain, a link including two ends and a central section, a first hoist clevis for pivotally attaching the first hoist socket to one link end and a second hoist clevis for pivotally attaching the second hoist socket to the other link end, and a third hoist clevis for pivotally attaching the hoist chain to the link

central section. A fourth hoist clevis also attaches a conventional dump block assembly and equalizer to the link central section.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a side elevation view of a rigging assembly and a digging bucket of this invention. Some parts are broken away.

Figure 2 is a front elevation view of the rigging assembly and bucket of FIG. 1 taken generally along the line 2 — 2 of Figure 1. Some parts are broken away.

Before one embodiment of the invention is explained in detail, it is to be understood that the invention is not limited in its application to the details of the construction and the arrangements of components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. Use of "including" and "comprising" and variations thereof as used herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. Use of "consisting of" and variations thereof as used herein is meant to encompass only the items listed thereafter and equivalents thereof. Further, it is to be understood that such terms as "forward", "rearward", "left", "right", "upward" and "downward", etc., are words of convenience in reference to the drawings and are not to be construed as limiting terms.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Before describing the new rigging assembly 10 and digging bucket 14, it is helpful to have an understanding of the general

arrangement and operation of a dragline (not shown). A dragline has crawlers or "walk-legs" used to move the machine from place to place. The upper works pivots with respect to such crawlers or walk-legs. A boom extends from the upper works and hoist ropes pass over rotatable pulley-like sheaves at the boom end. At the rigging assembly, hoist sockets 18 terminate such ropes. The hoist sockets 18 permit pin connections at what are, effectively, the ends of the ropes.

To excavate, the dragline bucket 14 is placed on the ground away from the dragline as shown in FIG. 1. With its teeth 22 rearward (facing the machine), such bucket 14 is drawn (or "dragged") toward such machine by the taut drag chain 26. During digging, the dump ropes 30 and the hoist chains 34 are somewhat slack. When the bucket 14 is filled, the hoist ropes raise it and the upper works is then pivoted to dump the bucket contents onto a pile.

More particularly, this invention provides a new bucket design including a base, a forward end, a rearward end, side walls and a rear wall, and one central hoist trunnion 38 and a trunnion link 42. Still more particularly, the one central hoist trunnion 38 is attached to the base and located between the center of gravity 15 and the rear wall. The bucket design is very different to conventional buckets due to the single hoist chain set-up. Weight can therefore be removed from top rail and side walls and some put back into the base or floor, which is now the major load-bearing element. The new result will be a modest weight saving which can be put back into payload.

The above allows a greater vertical taper to be used in the bucket sides 46 since the hoist trunnion does not need to be outside the bucket 14. This permits the use of a wider bucket,

without increasing lip width and its associated weight increases. It also allows more payload (material) to be carried above the top rail. In other words, the material is allowed to "hump up" over the top of the bucket 14. This happens with conventional buckets, but the wider bucket at the top rail allows more material to "hump up".

During bucket hoisting, the dump ropes 30, drag chains 26 and hoist chains 34 are all taut and to dump the bucket 14, tension is released on the drag chains 26. Since the bucket trunnion 38 is behind the bucket center of gravity 15, the bucket 14 rotates counterclockwise of its own weight (and that of its load) with the dump ropes 30 moving in the direction of the arrows as it does so. From the foregoing, it is apparent that the primary function of the dump ropes 30 is to control the position, horizontal or vertical, of the bucket 14. In other embodiments (not shown), the dump ropes 30 can be eliminated, with one hoist rope attached to the front of the bucket 14, and the other hoist rope attached to the bucket trunnion 38.

More particularly, as shown in Figures 1 and 2, the rigging assembly 10 includes spaced apart first and second hoist sockets 18, a hoist chain 34, a link 50 including two ends and a central section 54, a first hoist clevis 58 for pivotally attaching the first hoist socket to one link end and a second hoist clevis 62 for pivotally attaching the second hoist socket to the other link end, and a third hoist clevis 66 for pivotally attaching the hoist chain to the link central section 54. As can be seen in Figure 2, the link has openings 65 therein to further reduce the weight of the link 50.

Broken away from Figure 2, but shown in Figure 1, is a single extension 49 on the front of the link 50. A conventional dump block assembly 51, shown schematically in Figure 1, is

pivotally attached to the extension 49. As is conventional, a single dump block assembly can be used on smaller buckets, and two dump block assemblies (not shown), along with or without a dump rope equalizer (not shown), can be used. In still other embodiments (not shown), as is conventional, a hoist rope equalizer can also be used, along with the one central bucket trunnion 38.

The single hoist chain rigging 10 allows the spreader bar (not shown) to be eliminated along with various other components thereby achieving a significant weight reduction, which can be put back into payload. The combined weight reduction of the bucket 14 and rigging 10 can be invested in a stronger bucket structure for the applications where the more arduous mining conditions dictate a heavier bucket be utilized.

Various other features and advantages of the invention will be apparent from the following claims.